In the Claims

Please amend the claims as follows:

1. (Currently Amended) An optical element operable to compensate for dispersion associated with a transmission link, the optical element comprising:

an input port operable to receive an optical signal from at least one transmission link, the optical signal comprising ~~an~~ one or more optical signal wavelengths, ~~wavelength,~~ the at least one transmission link comprising a distributed Raman amplifier coupled to the input port and having a length, an optical loss, a dispersion, a sign of dispersion, and a cut-off wavelength;

a ~~distributed~~ Raman gain fiber coupled to the input port and ~~medium having an optical loss and connected to the input port, the distributed Raman gain medium~~ operable to amplify the optical signal and to compensate for dispersion associated with the at least one transmission link, wherein the ~~distributed~~ Raman gain fiber ~~medium~~ comprises a dispersion-length product that is ~~substantially~~ approximately equal in magnitude to a dispersion-length product of the at least one transmission link and wherein the ~~distributed~~ Raman gain fiber ~~medium~~ comprises a sign of dispersion that is opposite a sign of dispersion associated with the at least one transmission link;

~~a pump source configured to be coupled to the distributed Raman gain medium, the pump source operable to generate a pump signal to pump the distributed Raman gain medium to compensate for the optical loss of the transmission link and the optical loss of the distributed Raman gain, medium, wherein the pump source generates the pump signal at a pumping level sufficiently high so that the optical signal experiences a net gain; and~~

a first pump source coupled to the Raman gain fiber and operable to generate a first pump signal that traverses the Raman gain fiber in a first direction; and

a second pump source coupled to the Raman gain fiber and operable to generate a second pump signal that traverses the Raman gain fiber in a direction counter to the first direction, wherein the first pump signal and the second pump signal operate to compensate for the optical loss of the transmission link and an optical loss of the Raman gain fiber; and

an output port for outputting the amplified optical signal.

2. (Cancelled)

3. (Cancelled)

4. (Currently Amended) The optical element of Claim 1, ~~Claim 2,~~ wherein the Raman gain fiber has a cut-off wavelength shorter than the pump wavelength so that the gain fiber is single spatial mode for both the pump wavelength and the signal wavelength.

5. (Currently Amended) The optical element of Claim 1, ~~Claim 2,~~ wherein the optical signal is amplified in open loop fashion.

6. (Currently Amended) The optical element of Claim 1, ~~Claim 5,~~ wherein the distributed Raman amplifier ~~gain fiber~~ is pumped bi-directionally by a pumping mechanism. ~~the pumping mechanism.~~

7. (Currently Amended) The optical element of Claim 5, wherein the Raman gain fiber has two separate gain segments. ~~segments and wherein the pump source pumps the two segments in a counter-propagating fashion.~~

8. (Previously Presented) The optical element of Claim 7, further comprising an isolator to connect the two segments.

9. (Previously Presented) The optical element of Claim 7, further comprising a gain equalization element to connect the two segments.

10. (Previously Presented) The optical element of Claim 7, further comprising an optical add/drop multiplexer to connect the two segments.

11. (Previously Presented) The optical element of Claim 10, further comprising a gain equalization element connected to the optical add/drop multiplexer.

12. (Previously Presented) In a fiber-optic transmission system, the system comprising:

a signal input port operable to receive an optical signal from at least one transmission line, the optical signal comprising one or more signal wavelengths, the at least one transmission line having a length, an optical loss, a dispersion, a sign of dispersion, and a cut-off wavelength;

a Raman gain fiber coupled to the signal input port and operable to amplify the optical signal, the Raman gain fiber having an optical loss and comprising a first Raman gain segment and a second Raman gain segment, wherein the optical signal traverses the Raman gain fiber in a first direction;

a pump source configured to be coupled to the Raman gain fiber, the pump source operable to generate a pump signal to pump the Raman gain fiber to compensate for the optical loss of the transmission link and the optical loss of the Raman gain fiber, the pump signal comprising a pump wavelength and a pump power, wherein the pump source produces the pump signal at a pumping level sufficiently high so that the optical signal experiences a net gain;

a signal output port for outputting the optical signal; and

a pump shunt coupled to the signal input port and the signal output port, the pump shunt operable to couple at least a portion of the pump signal between the first Raman gain segment and the second Raman gain segment, wherein the first Raman gain segment is coupled to the signal input port and the second Raman gain segment is coupled to the signal output port and wherein the pump signal traverses the first Raman gain segment in a direction counter to the first direction and then traverses the second segment to deplete the pump power of the pump signal.

13. (Previously Presented) The system of Claim 12, further comprising an isolator to connect the first and second Raman gain segments.

14. (Previously Presented) The system of Claim 12, further comprising a gain equalization element to connect the first and second Raman gain segments.

15. (Previously Presented) The system of Claim 12, further comprising an optical add/drop multiplexer to connect the first and second Raman gain segments.

16. (Previously Presented) The system of Claim 12, wherein the second Raman gain segment is pumped bi-directionally by the pump source.

17. (Currently Amended) The optical element of Claim 1, ~~Claim 2,~~ wherein the optical signal is amplified in a closed loop fashion.

18. (Currently Amended) The optical element of Claim 1, ~~Claim 2,~~ wherein the Raman gain fiber at least partially defines a broadband cavity which is pumped bi-directionally by the pump source. ~~pumping mechanism.~~

19. (Currently Amended) The optical element of Claim 1, ~~Claim 2,~~ wherein the Raman gain fiber is a Raman gain fiber and wherein the broadband cavity is a Sagnac Raman cavity.

20. (Currently Amended) The optical element of Claim 1, ~~Claim 2,~~ wherein the distributed Raman gain fiber ~~medium~~ includes a circular loop cavity and wherein the gain fiber has two separate segments which are pumped in a counter-propagating fashion by the pump source. ~~pumping mechanism.~~

21. (Previously Presented) The optical element of Claim 1, wherein the transmission line is a multi-wavelength transmission line having non-uniform gain over different wavelength channels and further comprising a second optical element for evening the non-uniform gain over the different wavelength channels.

22. (Previously Presented) The optical element of Claim 21, wherein the second optical element includes at least one stage of Mach-Zehnder interferometers.

23. (Cancelled)

24. (Cancelled)

25. (Cancelled)

26. (Cancelled)

27. (Cancelled)

28. (Cancelled)

29. (Cancelled)

30. (Cancelled)

31. (Cancelled)

32. (Withdrawn) In a fiber-optic multi-band system including a multi-wavelength transmission line, a method for minimizing gain tilt within at least one existing band of wavelengths as additional bands of wavelengths are added, the method comprising:

adding a substantially equal number of additional bands both above and below the at least one existing band of wavelengths to obtain shorter and longer wavelength bands to minimize energy change in the at least one existing band of wavelengths; and

amplifying the shorter and longer wavelength bands so that each of the shorter and longer wavelength bands has a gain.

33. (Withdrawn) The method as claimed in claim 32 wherein the step of amplifying the shorter wavelength bands is accomplished with discrete or distributed Raman amplifiers.

34. (Withdrawn) The method as claimed in claim 32 wherein the step of amplifying the longer wavelength bands is accomplished with Erbium-doped fiber amplifiers wherein the gain in at least one of the shorter wavelength bands is greater than the gain in at least one of the longer wavelength bands.

35. (Withdrawn) The method as claimed in claim 32 wherein the gain in at least one of the shorter wavelength bands is greater than the gain in at least one of the longer wavelength bands.

36. (Withdrawn) The method as claimed in claim 32 wherein the step of amplifying the shorter wavelength bands is done in a distributed fashion.

37. (Withdrawn) In a fiber-optic multi-band transmission system including a multi-wave transmission line, the apparatus comprising:

a plurality of band pumps for pumping different bands of the transmission line to obtain amplification wherein band pumps for different bands interact non-linearly by exchanging energy; and

means for orthogonalizing adjacent band pumps to minimize the nonlinear interaction.

38. (Withdrawn) The apparatus as claimed in claim 37 wherein alternate band pumps are spatially dispersed to minimize interaction between band pumps for the different bands.

39. (Withdrawn) The apparatus as claimed in claim 37 wherein alternate band pumps are cross-polarized to minimize interaction between band pumps for the different bands.

40. (Withdrawn) The apparatus as claimed in claim 37 wherein the plurality of band pumps define a purely distributed system of distributed Raman amplifiers.

41. (Withdrawn) The apparatus as claimed in claim 37 wherein the plurality of band pumps define a hybrid system of discrete and distributed amplifiers.

42. (Withdrawn) The apparatus as claimed in claim 37 wherein the plurality of band pumps include discrete laser diodes for pumping the transmission line.

43. (Withdrawn) The apparatus as claimed in claim 37 wherein the plurality of band pumps include a Raman oscillator for pumping the transmission line.

44. (Currently Amended) The optical element of Claim 1, wherein each of the first pump source and the second pump source include ~~includes~~ at least one laser diode.

45. (Currently Amended) The optical element of Claim 1, wherein at least one of the first pump source or the second pump source includes a Raman oscillator.

46. (Currently Amended) The optical element of Claim 1, wherein at least one of the first pump source or the second pump source includes a Raman wavelength shifter.

47. (Currently Amended) The optical element of Claim 1, ~~Claim 2,~~ wherein the Raman gain fiber exhibits Raman scattering when pumped by at least one of the first pump source or the second pump source.

48. (Currently Amended) The system of ~~optical element~~ of Claim 20, wherein the distributed Raman gain medium includes chirped bragg gratings.

49. (Withdrawn) The invention as claimed in claim 37 wherein the amplification is distributed Raman amplification and wherein the energy is Raman energy.

50. (Cancelled)

51. (Currently Amended) The optical element of Claim 1, wherein the magnitude of the dispersion-length product of the distributed Raman gain medium that is approximately equal in magnitude to the dispersion-length product of the at least one transmission link comprises a dispersion-length product that is within ten percent (10%) of the magnitude of the dispersion-length product of the at least one transmission link.

52. (Cancelled)